Payload design for the Lunar Flashlight mission:

Illuminating the Moon's South Pole

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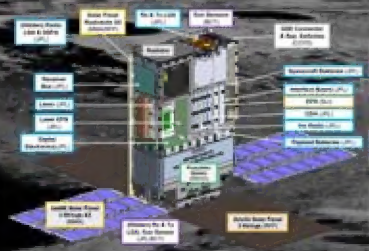
Water at the Lunar Poles?

Recent reflectance data from LRO instruments suggest water ice and other volatiles may be present on the surface in lunar permanently shadowed regions, though the detection is not yet definitive (*Gladstone et al. 2012, Zuber et al. 2012, Hayne et al. 2015*). Understanding the composition, quantity, distribution, and form of water and other volatiles associated with lunar permanently shadowed regions (PSRs) is identified as a NASA Strategic Knowledge Gap (SKG) for Human Exploration. These polar volatile deposits are also scientifically interesting, having the potential to reveal important information about the delivery of water to the Earth-Moon system.

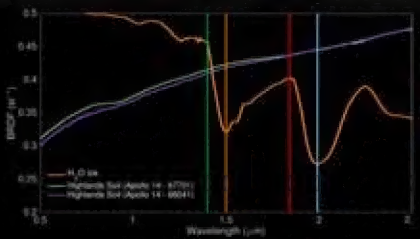
The Lunar Flashlight Mission

The Lunar Flashlight (LF) mission is a 6U CubeSat, to be launched as a secondary payload on the first test flight (EM-1) of the Space Launch System (SLS), currently scheduled for 2018. **The goal of LF is to determine the presence or absence of exposed water ice and map its concentration at the 1-2 kilometer scale.** After being ejected in cislunar space by SLS, Lunar Flashlight maneuvers into a low-energy polar orbit with a perilune of 10-30 km above the lunar south pole.



Measurement Approach

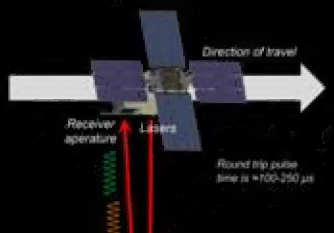
Lunar Flashlight's four-channel laser projector will illuminate permanently shadowed regions, measuring surface reflectance at wavelengths where water ice absorbs. Water ice will be distinguished from dry regolith in two ways: 1) spatial variations in albedo, and 2) reflectance ratios between absorption and continuum channels. Water ice band depths will be mapped in order to distinguish the composition of the PSRs from that of the sunlit terrain. These data will be highly complementary to other lunar datasets, including LRO.

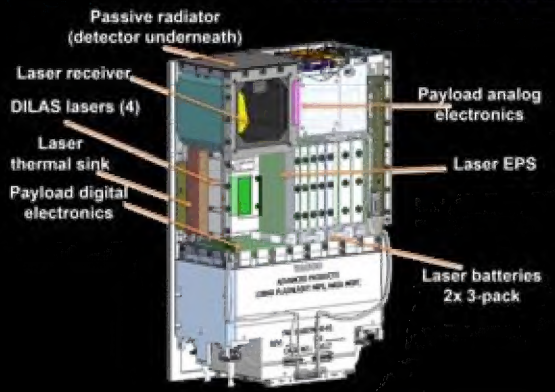


The Lunar Flashlight Payload

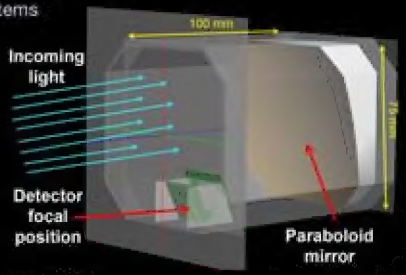
Lunar Flashlight will be the first planetary mission to use an active multi-band reflectometer

- Observe permanently shadowed and eclipsed ground within 80°S
- 1ms time pulsing of 4 lasers, plus one dark ms
- Independent laser power subsystem and power monitoring
- 1-single pixel detector reflectometer sensitive over 1-2μm
- Raw data collection and transfer from SC to ground systems



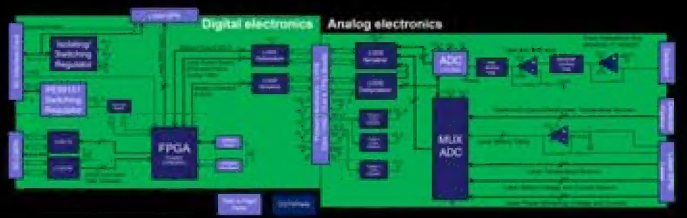


Receiver:
- Field-of-view: 14 mrad
- Volume 88.9 x 99.06 x 88.9 mm
- Passively cooled by external radiator



Detector
- 1mm diameter Teledyne Judson InGaAs detector
- 2.2μm cutoff
- 1.1A/W responsivity
- Detector operational T: 208 K

Mirror Surface:
- AR-coated aluminum bare mirror for 1- 2 μm
- Radius of curvature: 140mm
- Conic constant: -1
- Figure 2λ @ 632.8 nm
- RMS roughness: <30Å



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